

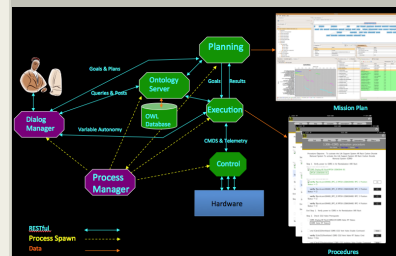
A Flexible Cognitive Architecture for Space Exploration Agents, Phase I

Completed Technology Project (2017 - 2017)



Project Introduction

In space operations, carrying out the activities of mission plans by executing procedures often requires close collaboration between ground controllers who have deep knowledge of the spacecraft's systems and crewmembers who have on-board situation awareness. Because of the light distances involved, this close collaboration will not be practical for inter-planetary exploration. This proposal seeks to develop a software cognitive architecture for space exploration (CASE) that will autonomously carry out exploration operations by using the same knowledge and executing the same plans and procedures as those developed on Earth. Over the past several years, TRAC Labs, in support of NASA and other government agencies, has developed a number of components that can be used in such an architecture, and now proposes to design an exploration agent based on that architecture and to show that it is feasible for use in space exploration. These components include a procedure development system known as PRIDE that allows for variably autonomous execution of both crew and robotic procedures, an automated planner that plans and re-plans the execution of procedures to achieve overall mission goals, and an ontology data management system that makes system states available to all the components. In this work we will develop two new but vital elements for the architecture: a process manager that will manage the use of distributed computing resources to support the CASE components, and a natural language dialog system to allow the crew access to any part of the architecture. CASE will provide a feasible approach to agent design for space exploration, provide on-board autonomy in nominal operations and human-computer solutions for off-nominal operations, allow for the interchange of components from external sources and be robust in the face of computational failures.



A Flexible Cognitive Architecture for Space Exploration Agents, Phase I Briefing Chart Image

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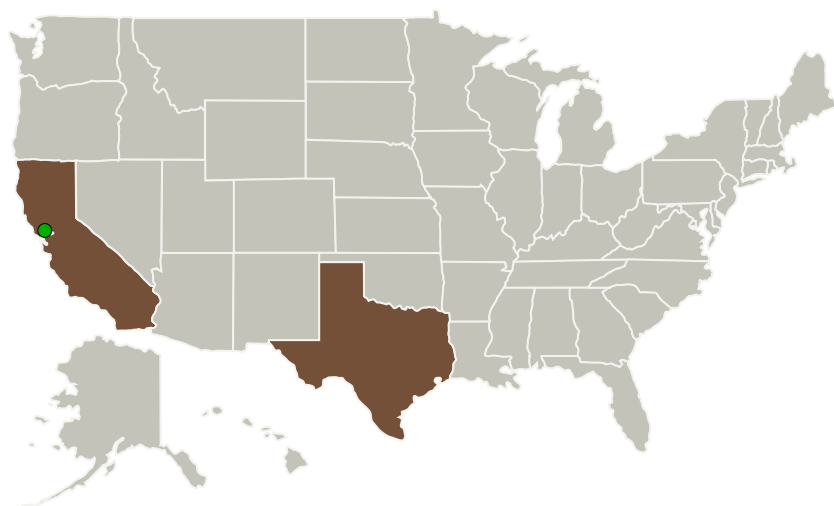
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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
TRAC Labs, Inc.	Lead Organization	Industry	Webster, Texas
● Ames Research Center (ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations

California	Texas
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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

TRAC Labs, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

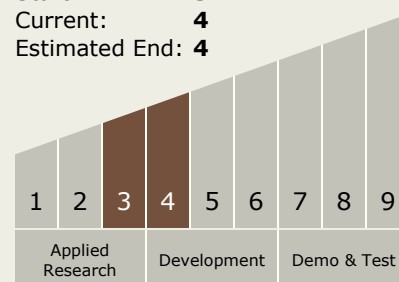
Carlos Torrez

Principal Investigator:

Russell Bonasso

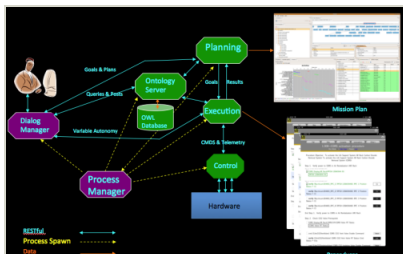
Technology Maturity (TRL)

Start: 3
 Current: 4
 Estimated End: 4





Images



Briefing Chart Image

A Flexible Cognitive Architecture for Space Exploration Agents, Phase I

Briefing Chart Image

(<https://techport.nasa.gov/image/135727>)

Technology Areas

Primary:

- TX10 Autonomous Systems
 - └ TX10.4 Engineering and Integrity
 - └ TX10.4.5 Architecture and Design of Autonomous Systems

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System